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GENERAL NOTES.

The *Astronomical Journal* of May 20th contains an article on the orbit of the fifth satellite of *Jupiter*, by EMILY ELIZABETH DOBBIN. The elements of Dr. COHN have been corrected by the observations of Professor BARNARD made subsequent to 1894. "The most noticeable feature of these results is the smallness of the eccentricity, as compared with that obtained by Dr. COHN and M. TISSERAND. Whether the change is real, and denotes a progressive perturbation which will end in reducing the ellipse to a perfect circle, or is an accidental one, can only be decided after another decade or more."

The computer has used only the observations of Professor BARNARD and justifies this course by the statement: "Only the observations of Professor BARNARD are considered in this paper, though I am aware of the extensive labors of Dr. R. G. AITKEN of the Lick Observatory. The homogeneity gained by excluding such observations seems to more than balance any loss in quantity."

This reasoning seems a bit odd to some of us who have been "brought up" differently. The procedure amounts, practically, to rejecting all observations except Professor BARNARD'S. There is some question as to what the author means by homogeneity, and it is to be regretted that further explanation is not given. Dr. AITKEN'S observations of the Fifth Satellite were made by connecting it with one or more of the other satellites, while Professor BARNARD'S were, I believe, made by measuring the distance of the satellite from *Jupiter's* limb. Here are two quite different methods of observing and in order to make the two series comparable it might be necessary to employ reduction factors whose exact values are not known. It is to be inferred, however, from the sentence quoted above that it would have been possible to include other observations.

Beginners usually find it very easy to reject observations and most teachers of the Method of Least Squares have to spend considerable time trying to teach their students that observations should never be rejected except for good and sufficient reasons. These can be defined in a general way, but as far as my experience goes "lack of homogeneity" has never been accepted as a good and sufficient reason. If there is a

difference between the results of two series of observations there is but one explanation, namely, that either one or both of the series is affected by systematic errors. To be sure, smaller probable errors and nicer looking results may usually be obtained by using only one series of observations, but if two or more series be employed the probabilities are that the results will be nearer the *truth*. To obtain as nearly the truth as possible should be the aim of every scientific investigation. In the present case the aim seems to have been to satisfy as nearly as possible one man's observations. Instead of rejecting other observations the computer should welcome them with open arms, and if the number becomes unwieldy it would be better, in general, to reject some of each rather than all of one. An excellent example of the benefit to be derived from combining the observations made with different instruments has been brought forth recently by Mr. HINKS, in his determination of the solar parallax from observations of *Eros*, reference to which may be found on page 225.

S. D. T.

The *Astrophysical Journal* for June contains an interesting article by Professor LANGLEY, on a possible variation of the solar radiation and its probable effect on terrestrial temperatures. By way of introduction Professor LANGLEY states: "The purpose of the present communication is primarily to discuss the validity of a surmise we may entertain, founded on observations here, as to certain possible changes in the solar constant. There is especially discussed a possible falling off of solar radiation about the close of March, 1903, as indicated by certain recent values of solar radiation computed from observations here, and compared with actually observed temperatures for eighty-nine stations of the North Temperate Zone."

Without going into the details of the observations we quote Professor LANGLEY's summary and conclusion: "A series of determinations of the solar radiation outside the atmosphere (the solar constant), extending from October, 1902, to March, 1904, has been made at the Smithsonian Astrophysical Observatory under the writer's direction.

"Care has been exercised to determine all known sources of error which could seriously affect the values relatively to each other, and principally the varying absorption of the Earth's

atmosphere. Though uncertainty must ever remain as to the absorption of this atmosphere, different kinds of evidence agree in supporting the accuracy of the estimates made of it and of the conclusions deduced from them.

"The effects due to this absorption having been allowed for, the inference from these observations appears to be that the solar radiation itself fell off about 10 per cent, beginning at the close of March, 1903. I do not assert this without qualification, but if such a change in solar radiation did actually occur, a decrease of temperature on the Earth, which might be indefinitely less than $7^{\circ}.5$ C., ought to have followed it.

"On comparing the observed temperatures of 89 stations, distributed over the North Temperate Zone, with the mean temperatures of the same stations for many previous years, it is found that an average decrease of temperature of over 2° C. actually did follow the possible fall of the solar radiation, while the temperature continued low during the remainder of the year. Stations remote from the retarding influence of the oceans show a much greater variation than that of the general mean.

"While it is difficult to conceive what influence, not solar, could have produced this rapid and *simultaneous* reduction of temperatures over the whole North Temperate Zone, and continued operative for so long a period, the evidence of solar variation cannot be said to be conclusive. Nevertheless, such a conclusion seems not an unreasonable inference from the data now at hand, and a continuation of these bolographic studies of solar radiation is of increasing interest, in view of their possible aid in forecasting terrestrial climatic changes, conceivably due to solar ones."

In the *Monthly Notices* for June Mr. HINKS, of Cambridge Observatory, presents an interesting article on the determination of the solar parallax from a reduction of photographs of *Eros*. Mr. HINKS developed some methods of reduction, and in order to test their practicability secured from several observatories measurements of all the plates taken between November 7th and 15th, which is only a small part of the interval over which photographs of *Eros* were taken. The

measurements were contributed by the observatories at Algiers, Cambridge, Minneapolis, Mount Hamilton, Northfield, Oxford, Paris, San Fernando, and Tacubaya, and a total of 295 plates are discussed in the paper.

The value of the parallax obtained is $8''.7966$, which is in very close agreement with the value used in the almanacs.

Almost all of the measurements were found to be affected by systematic errors of some sort, many of which it would have been impossible to find had the measurements made at each observatory been discussed separately. This is an excellent illustration of the point which I have attempted to bring out in the first one of these notes,—that, in general, it is always better if possible to discuss together the observations made with various instruments rather than to take alone those made by one man with one instrument to the exclusion of all others.

S. D. T.

The following notes have been taken from recent numbers of *Science*:—

Dr. MICHELERHANA, of the Observatory of Milan, has been made director of the observatory at Bologna.

Mr. H. C. RUSSELL, government astronomer of New South Wales, will retire at the end of the present year, after a service of forty-six years.

Professor SIMON NEWCOMB has been elected corresponding member of the Berlin Academy of Sciences.

M. HAMY, assistant astronomer in the Paris Observatory, has been appointed astronomer in the room of the late M. CALLANDREAU.

Dr. HANS BATTERMAN, astronomer at the Berlin Observatory, has been made director of the observatory and professor of astronomy at Königsberg.

The following interesting announcement is taken from *Science*:—

With the aid of a grant of \$10,000 from the Carnegie Institution, for use during the current year, the Yerkes Observatory of the University of Chicago has sent an expedition to Mt. Wilson (5,886 feet), near Pasadena, California, for the pur-

pose of making special investigations of the Sun. The principal instrument to be erected on the mountain is the Snow horizontal telescope, recently constructed in the instrument and optical shops of the Yerkes Observatory as the result of a gift from Miss HELEN SNOW, of Chicago. This telescope is a cœlostæt reflector, the cœlostæt mirror having a diameter of thirty inches. A second plane mirror, twenty-four inches in diameter, reflects the beam north from the cœlostæt to either one of two concave mirrors, each of 24-inch aperture. One of these concave mirrors, of about sixty feet focal length, is to be used in conjunction with a solar spectrograph of five inches aperture and thirteen feet focal length; a spectroheliograph of seven inches aperture, resembling the Rumford spectroheliograph of the Yerkes Observatory; and a stellar spectrograph provided with a large concave grating and mounted in a constant-temperature laboratory. It is hoped that it will be possible with this stellar spectrograph to photograph the spectra of a few of the brightest stars. For fainter stars the spectrograph is to be provided with several prisms, for use singly or in combination. The second concave mirror of the cœlostæt reflector is designed to give a large focal image of the Sun, especially adapted for investigations with a powerful spectroheliograph and for spectroscopic studies of sun-spots and other solar phenomena. The focal length of this mirror is about 145 feet, so that it will give a solar image about sixteen inches in diameter. The spectroheliograph for use with this large solar image is to be seven inches aperture and thirty feet focal length. For the present, until a suitable grating can be obtained, the dispersive train of this instrument will consist of three prisms of 45° refracting angle, used in conjunction with a plane mirror, so as to give a total deviation of 180° . The motion of the solar image, of which a zone about four inches wide can be photographed with the spectroheliograph, will be produced by rotating the concave mirror about a vertical axis by means of a driving-clock. A second driving-clock, so controlled as to be synchronous with the first, will cause the photographic plate to move behind the second slit. Three slits will be provided at this point, so as to permit photographs to be taken simultaneously through as many different lines of the spectra. It is hoped that this

spectroheliograph will prove to be well suited for use with some of the narrower dark lines of the solar spectrum.

The work of the expedition is under the immediate direction of Professor GEORGE E. HALE, director of the Yerkes Observatory. During his absence Professor E. B. FROST will be in immediate charge of the Yerkes Observatory, with the title of acting director. Professor FROST will also be the managing editor of the *Astrophysical Journal*. Mr. FERDINAND ELLERMAN and Mr. WALTER S. ADAMS will be associated with Professor HALE in the work on Mt. Wilson.

Professor S. W. RITCHEY, superintendent of instrument construction at the Yerkes Observatory, will be in charge of an instrument-shop which is being fitted up for the expedition to Pasadena.

The following obituary notice of THEODORE BREDICHIN is taken from the July number of the *Observatory*:—

With regret we have to announce the death of this distinguished Russian astronomer, which took place on May 14th last. BREDICHIN, who was a member of a noble family, was born at Nicolajoff on December 8, 1831. He was first educated at the Richelieu Lyceum in Odessa, and in 1851 became a student in the physico-mathematical faculty of the University of Moscow. In the year 1857 he was made Professor of Astronomy, and in 1873 Director of the University Observatory. He approached astronomy from many sides. He was the first in Russia to make spectroscopic observations of stars. He made observations of star-positions, of time of swing of pendulums, but his most famous works are his valuable contributions to the theory of the forms of comets and of meteor streams. In the year 1891 he succeeded OTTO STRUVE as Director of the Russian National Observatory at Poulkova, from which office he retired in 1894 on account of advancing years and the state of his health, for which the climate of Poulkova was not suitable.

Dr. ISAAC ROBERTS, F. R. S., died in July last in his seventy-fifth year. A large portion of his life was devoted to spectrum analysis, astronomy, and other kindred branches of science.

For several years he pursued stellar photography with powerful instruments specially constructed for the purpose, and succeeded in adding considerably to the knowledge of the stars, clusters, and nebulæ. In 1885 he commenced to chart by photography the stars in the northern hemisphere of the sky, but ere he had been a year engaged upon this work the French astronomers arranged that the charting of the stars should be done internationally on a uniform scale by instruments of similar construction. Dr. ROBERTS thereupon turned his attention to special researches on star-clusters and nebulæ, with long exposures of the photographic plates. These photographs have been regarded with the highest interest and admiration wherever they have been exhibited. He devised a method and a machine by which the stars that have been photographed can with accuracy be engraved directly from the negatives on copper plates for the purpose of printing; the machine is also adapted for measuring the positions and magnitudes of the stars.

The annual visitation of the Royal Observatory, Greenwich, took place on the first Saturday of June. The visitors included Sir DAVID GILL, Director of the Observatory at Cape of Good Hope, who was on a visit to England.

One rather unexpected feature in the Astronomer Royal's report is that, in spite of the unprecedented rainfall of last year, the number of observations in all departments is unusually high, the number of transits obtained with the transit circle being 13,270, the greatest number on record. In addition to the continuous observation of Sun, Moon, and planets, this instrument is devoted to the formation of a complete catalogue of all the stars from the first to the ninth magnitude that lie within 26 degrees of the North Pole. The total number of stars is about 10,000, five observations of each being required. This work is so well advanced that it has been decided to close the observations for the catalogue at the end of 1905, a year earlier than was originally intended.

The Moon was observed 106 times with the transit circle and 88 times with the altazimuth, the results showing that the Right Ascensions given in the Nautical Almanac require to be increased by 0.19 second on the average. The amount of the

correction has been increasing rather rapidly in recent years, indicating that the mean motion used by the Nautical Almanac (HANSEN corrected by NEWCOMB) is slightly too small.

One important feature of last year's work has been the exhaustive analysis to which the observations of the Moon made at Greenwich during the last 150 years have been subjected by Mr. COWELL. He devised a method which enormously diminishes the labor of the analysis. One of the most interesting terms is that known as the parallactic inequality, from which the Sun's distance is deducible; the coefficient of this is found to be 124.75 seconds of arc, implying that the Sun's parallax is 8.778 seconds and his distance 93,130,000 miles. The semi-diameter of the Moon is found to be 933.75 seconds of arc, about one third of a second less than HANSEN'S value, and one second greater than the value deduced from occultations, the difference being chiefly due to irradiation at the Moon's bright limb. It would appear, therefore, that this irradiation is less than was formerly supposed. It may be noted that the Nautical Almanac will shortly supply predictions for Greenwich of occultations of stars down to the seventh magnitude, which will considerably increase the number of predicted phenomena. The great 28-inch equatorial has been devoted entirely to double-star work; 512 pairs were observed, of which 178 were less than one second apart, and 85 less than half a second. The two most difficult pairs were *Kappa Pegasi* (observed on 14 nights) and *Epsilon Hydræ* (observed on four nights), the distance in each case being one tenth of a second.

A very interesting photograph of BORRELLY'S Comet was obtained on August 1st, with an exposure of forty minutes; it shows nine distinct tails arranged in the form of a fan, the shape resembling that of SWIFT'S Comet of the preceding year.

The Sun was photographed at Greenwich on 220 days, and plates from Mauritius and India are available on 122 days, leaving only 23 days in the year without a record; some of these will be filled up, as there are some more plates to come from Mauritius. The solar activity shows a notable increase; there were only 25 days without spots, as compared with 190 in the previous year, and the mean daily spotted area increased sixfold.

It may be mentioned that a series of photographs illustrat-

ing the work of the Royal Observatory has been sent to the St. Louis Exhibition.—Extract from *The Times* of June 6, 1904.

Four hundred and fifty guests were invited by the French Astronomical Society to pass the night on the Eiffel Tower, Paris, on "Tuesday, the 21st of June, date of the Summer Solstice." The gathering was the first of the sun festivals which the Astronomical Society, inspired by its poetically tempered ex-President, M. FLAMMARION, has resolved to perpetuate. It is simply a scientific festival, with the propagation of popular interest in the wonder and beauty of the universe as one of its chief motives. All were congregated on the first landing of the tower, when the crash of a gun down below, on *terra firma*, announced that the Sun had at that moment reached the solstice. Time, twenty-eight seconds past nine.

The venerable President of the Society, M. JANSSEN, welcomed his guests at the theater on the first landing and read a short discourse, after which M. FLAMMARION delivered an eloquent address on Sun worship in the world's past, on the Sun's influence in the stellar system, and on astronomical discovery. The address was followed by a great many beautiful illustrations projected on a white screen. After that there were hymns to the Sun, invocations to the Sun and prayer to the Sun, from composers and poets, sung and repeated by artists from the Opera. A luxurious luncheon at midnight followed. Thereafter about fifty guests went to the top of the tower and waited for sunrise.—From the London *Daily News*.

The honorary degree of D. Sc. has been conferred by the University of Oxford on Sir DAVID GILL, Astronomer Royal, Cape of Good Hope.
